



THE DIFFERENTIAL IMPACT OF FEDERAL AND STATE MINIMUM WAGES ON TEENAGE EMPLOYMENT

Stephen Bazen, Julie Le Gallo

► To cite this version:

Stephen Bazen, Julie Le Gallo. THE DIFFERENTIAL IMPACT OF FEDERAL AND STATE MINIMUM WAGES ON TEENAGE EMPLOYMENT. 2009. halshs-00382509

HAL Id: halshs-00382509

<https://shs.hal.science/halshs-00382509>

Preprint submitted on 7 May 2009

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

GREQAM

**Groupeement de Recherche en Economie
Quantitative d'Aix-Marseille - UMR-CNRS 6579
Ecole des Hautes Etudes en Sciences Sociales
Universités d'Aix-Marseille II et III**

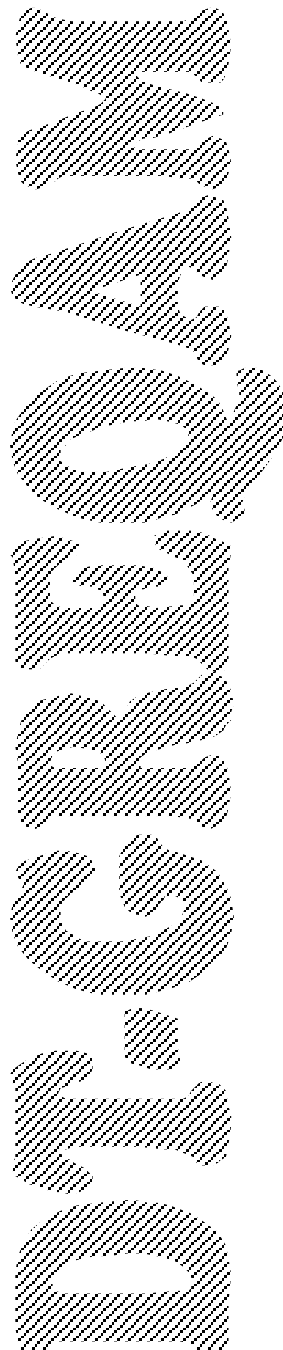
**Document de Travail
n°2009-07**

THE DIFFERENTIAL IMPACT OF FEDERAL AND STATE MINIMUM WAGES ON TEENAGE EMPLOYMENT

Stephen BAZEN

Julie LE GALLO

February 2009



THE DIFFERENTIAL IMPACT OF FEDERAL AND STATE MINIMUM WAGES ON TEENAGE EMPLOYMENT

STEPHEN BAZEN*

(GREQAM, Université de la Méditerranée, Marseille, France)

JULIE LE GALLO**

(CRESE, Université de Franche-Comté, France)

FEBRUARY 2009

Earlier versions of this paper have benefited from comments from Alain Trannoy, Jonathan Wadsworth, an anonymous referee and participants at seminars at the universities of Aix-Marseille, Geneva, Lyon, Milan, Savoie, and at the LoWER conference in Mannheim, April 2005. We are particularly grateful to Alan Manning for providing the minimum wage series.

* Professor of Economics, GREQAM, Université de la Méditerranée, Centre de la Vieille Charité, 13236 Marseille cedex 2, France. Phone: (33) 491 140 739

Email : stephen.bazen@univmed.fr

** Professor of Economics, Université de Franche-Comté, 45d Avenue de l'Observatoire, 25030 Besançon cedex, France. Phone: (33) 3 81 66 67 52

Email : jlegallo@univ-fcomte.fr

THE DIFFERENTIAL IMPACT OF FEDERAL AND STATE MINIMUM WAGES ON TEENAGE EMPLOYMENT

Abstract

The ‘new economics of the minimum wage’ is based on the findings from case studies that minimum wages had no effect on employment and may even have increased it. This conclusion is at odds with the findings of earlier studies and those of a number of more recent studies which find a statistically significant negative effect on teenage employment. These conflicting results constitute a puzzle. We find that this is due to minimum wage hikes implemented at the state-level having no negative effects on teenage employment during the 1980s and 1990s, while the federal hikes of the 1990s did. In states without their own minimum wages, the decline in the relative value of the federal minimum wage during the 1980s gave rise to an increase in low-wage employment that was subsequently checked and reversed by the federal hikes in the early 1990s.

Key words: Federal Minimum Wages, State Minimum Wages, Teenage

Employment

JEL Codes: J23, J38

Introduction

The ‘new economics of the minimum wage’ is based on a number of studies which showed that during the 1980s and 1990s, minimum wage increases had no significant effects on the employment of those most affected and sometimes were even found to have positive employment effects (Card and Krueger, 1994, 1995, 2000). These findings have generated and continue to generate a good deal of debate¹ for a number of reasons. Firstly, they are at odds with the predictions of orthodox economic theory, that in a competitive market a binding price increase would lead to a reduction in demand. While the idea of monopsony in the labor market has gained a certain degree of support (see for example Manning, 2003) many economists are unconvinced that it is appropriate for the analysis of low-wage labor markets. Secondly, the results presented by Card and Krueger (1995) are in stark contrast to those obtained in the large number of studies that underpinned the consensus which emerged in the early 1980s, according to which minimum wage hikes had a small but statistically significant negative impact on teenage employment (Brown, Gilroy and Kohen, 1982, 1983).

The federal minimum wage was frozen at \$3.35 from 1981 until early 1990, and during this period a number of states increased their own minimum rates above the \$3.35 figure. The main evidence concerning the absence of negative employment effects comes from the analysis of minimum wage hikes implemented at the state level. In this paper we take advantage of this context to examine the differences in the impact of minimum wages implemented at the state and federal levels in order

¹ See for example the review article by Kennan (1996) and Neumark and Wascher’s (2000) re-working of the original 1994 Card and Krueger study.

to shed light on why different studies report contradictory results. This is of particular interest in the debate over whether or not minimum wages have a negative impact on employment, since the consensus recorded in the Brown, Gilroy and Kohen (1982) survey relates essentially to the impact of federal minimum wage hikes. Although Card (1992) using state-level data finds no evidence of a significant employment impact of the 1990 federal minimum wage hike, Deere, Murphy and Welch (1995) using the same data source find that the 1990 and 1991 federal increases reduce teenage employment. Using long time series, both Williams and Smith (2001) and Bazen and Marimoutou (2002) find negative and statistically significant effects of federal minimum wages on teenage employment.

The main evidence concerning the absence of negative employment effects comes from the analysis of minimum wage hikes implemented at the state level in California and New Jersey. Card and Krueger (1995) find no evidence of detrimental employment effects and in New Jersey employment may even have increased as a result of the minimum wage hike (Card and Krueger, 1994, 2000). This conclusion is reinforced by evidence from panel data analysis of state and federal minimum wage hikes using data on states for a number of years. For example, Card and Krueger (1995, Chapter 7), with data from the Current Population Survey (CPS) for a cross section of states, find no evidence of significant employment effects due to state or federal minimum wages. However, using the same data source, Burkhauser, Crouch and Wittenberg (2000) show that this is due to the presence of time dummies that swamp the effect of the federal minimum wage in 1990-91. When the time dummies are removed they find consistently negative effects of minimum wages on teenage employment. Neumark

and Wascher (2002) using a disequilibrium switching regime model find negative effects of state and federal minimum wages for the period 1973-89².

In this paper we show that during the period 1982 to 1989 in which the federal minimum was frozen, there is no evidence of statistically significant negative employment effects for teenagers associated with state-level minimum wages. However the federal minimum wage hikes implemented in the early 1990s are found to have a statistically significant negative impact on teenage employment. These conclusions are confirmed for the subsequent period when the federal minimum remained unchanged for four years before being increased again in 1996. The conflicting results found by different studies would appear to be due to the type of minimum wage hike studied. Time series studies examine the effect of federal hikes while case studies evaluate the employment impact of state-level minimum wages.

We proceed by first describing the state-level minimum wage increases that were implemented during the 1980s and 1990s in section 1. We then present a descriptive analysis of the CPS state-level data that we use in section 2. In the following section, using the same model specification as Burkhauser et al. (2000) with quarterly data covering the same period, we present estimates of the impact of state-level minimum wage hikes on teenage employment-population ratios for the period up to 1989, a period in which the federal minimum wage was frozen at

² Neumark and Wascher (1994) also find negative employment effects using state panel data, but their model specification has been criticised for including the teenage school enrolment rate as an explanatory variable - see for example, Card and Krueger (1995).

\$3.35. In section 4 we use the same approach to examine the employment impact of the federal hikes implemented in the 1990s. In section 5 we suggest possible explanations for our findings.

I. State-level and federal minimum wage increases

The federal minimum wage was frozen at \$3.35 from when it was implemented in 1981 until 1990, and was increased by 13.4% in April 1990 to \$3.80. However, thirteen states implemented increases in their own legal minimum rates in between these federal minimum wage hikes. Furthermore, most of these states implemented more than one increase during the period. We exclude from our analysis the District of Columbia which from the outset of the period studied had a minimum wage above the federal rate, and which implemented annual increases up to 1988 and froze its minimum at \$4.33 from 1988 to 1993. We also exclude the two non-contiguous states Alaska and Hawaii. Thus our study examines the consequences of the twenty-six increases enacted in eleven different states between 1982 and 1989. It is interesting to note that nineteen of these hikes were implemented in six states in the New England division. By January 1st 1990, six of these states already had a minimum wage at or above the value of the 1990 federal minimum of \$3.80. There was a further hike in the federal minimum wage in April 1991 to \$4.25, and seven states already had minima at or above this rate in January 1991.

The federal minimum remained unchanged again from 1991 to 1995 and was increased in October 1996 to \$4.75. In the intervening period 1992-5, four states increased their minimum wage rates and by January 1st 1996, three already had rates higher than \$4.75. A further increase in the latter to \$5.15 was implemented in

September 1997 and this affected all but three of the included states³ (since we have excluded from the outset the District of Columbia and the two non contiguous states). Figure 1 displays the state-level minimum wage rates that were set over the period 1984-1995 other than those that occurred due to federal hikes.

II. Data

We are interested in how state teenage employment rates change in relation to the minimum wage, and like many previous studies we use the Current Population Survey Merged Outgoing Rotation Groups. These data are constructed from the monthly CPS returns and only respondents in their fourth or eighth month in the survey are included. We use quarterly data for the years 1984 to 1998, corresponding to the minimum wage hikes described above. Descriptive statistics show that annual teenage employment-population ratios vary enormously between states – from a minimum of 25% to a maximum of nearly 65%. What we are interested in here is how the ratio varies over time for states affected by minimum wage hikes. Table A.1 in the appendix provides means and standard deviations of the key variables used in this paper. It can be seen that during periods when there are no federal minimum wage increases, the teenage employment-population ratio rises and it falls in the years when there are hikes. In fact the ratio is roughly the same in 1984 and in 1997, despite having risen by around 4 points when the federal minimum remained unchanged for a long period.

³ On January 1st 1997 the state minimum was raised above \$5.15 in Massachusetts (to \$5.25) and Oregon (to \$5.50), and in California (to \$5.50) in March 1997.

Figures 2 and 3 display the changes in annual teenage employment by states over the periods 1985-1989 and 1992-1995 respectively. The states that implemented increases in their own legal minimum rates between the federal minimum hikes are drawn in light grey, and it is clear that in most of these, teenage employment increased between 1985 and 1989, with the exception of Connecticut, New Hampshire and Massachusetts. In the period 1992-1995, there were only four state-level increases and in each of the states concerned, the teenage employment population ratio increased. Nevertheless, we have to compare these changes relative to what happened in other states and to take into account other influences on teenage employment.

III. The impact of state and federal minimum wage hikes 1984-91

In order to test the hypothesis that minimum wage hikes have no effect on teenage employment, we adopt the same underlying fixed effects specification as Burkhauser et al. (2000) who estimate an equation of the form with pooled state data:

$$E_{st} = \phi_s + \phi_1 U_{st} + \phi_2 P_{st} + \phi_3 w_{st} + \theta m_{st} + v_{st}$$

where v_{st} is the error term, s refers to the state and t to a month/year. E is the teenage employment-population ratio, U is the rate of unemployment among prime-age males, w is the logarithm of average usual earnings of adult workers and m is the logarithm of the prevailing minimum wage – the higher of the state or federal minima. The equation is estimated with state fixed effects ϕ_s .

We estimate this equation using quarterly state data by eliminating the fixed effects by taking first differences⁴. We use first *annual* differences of the time-varying variables – that is $\Delta z_{st} = z_{st} - z_{st-4}$ where t represents a quarter, so that the variable represents the change for the same quarter over a twelve month period. Minimum wage increases are recorded in the quarter in which they became effective. Taking first differences the equation becomes:

$$\Delta E_{st} = \phi_1 \Delta U_{st} + \phi_2 \Delta P_{st} + \phi_3 \Delta w_{st} + \theta \Delta m_{st} + \Delta v_{st} \quad (1)$$

The first difference transformation is preferred to the traditional deviations from means specification in order to facilitate analysis of different sub-periods⁵. Estimates of the standard errors are obtained from a bootstrap procedure using block residual re-sampling (see for example Brownstone and Valetta, 2001). Because the error term in the first difference equation may not be serially uncorrelated, using the block residual bootstrap procedure retains any temporal dependence there may be in the residual.

We first estimate equation (1) for the period 1984 to 1989, a period in which there were no hikes in the federal minimum. The year 1984 rather than an earlier year is chosen since among the states used in this study, the first state minimum wage hike after the 1981 federal increase was in 1985 (in Maine). The results in the first

⁴ In an earlier version of this paper we used annualised data. The results do not change by much, although precision is obviously improved due to a larger number of degrees of freedom.

⁵ Similar results for the overall period are obtained when the within-group estimator (variables expressed as deviations from time means) is used.

column of Table 1 indicate that overall there is a small positive but insignificant effect of minimum wage increases on teenage employment. In the period up to 1989 state-level minimum wage hikes did not have adverse effects on employment. The other explanatory variables have expected signs although only adult average earnings have a significant impact on teenage employment during the 1984-89 period. In column (2) the same equation is estimated including year dummies and while the estimated minimum wage coefficient is negative, it is far from being significant at conventional levels with a t value of -0.9 (and only one year dummy – for 1988 – has a significant coefficient and this is positive).

In order to evaluate the effect of the federal minimum wage hike of April 1990 from \$3.35 to \$3.80, we begin by re-estimating equation (1) for the years 1984-91(1). This period incorporates quarters up to one year after the 1990 hike but ends before the implementation of the April 1991 hike. The inclusion of the period up to 1991 first quarter during which the federal minimum was raised to \$3.80, causes the minimum wage coefficient to become negative and statistically significant (when no year dummies are included, see column 3). The estimated coefficient of -0.202 translates into an elasticity figure of -0.42 and this is in line with the elasticities reported by Burkhauser et al. (2000) using monthly data. However the latter also find that the effect of the minimum wage is numerically smaller in absolute value and not statistically significant when year dummies are included in this regression⁶. When we add year dummies to the equation for 1984-91(1) the

⁶ In Table 3 on page 663 of their article, it can be seen that for the period 1979-92 the minimum wage coefficient changes from -0.186 (t value -13.3) to -0.028 (t value -1.0) when year dummies are included.

estimated coefficient is negative but not significant (in column 4). The same results are obtained when the period up to 1992 first quarter during which the federal minimum was further raised to \$4.25 (columns 5 and 6). Furthermore the year dummies for 1990 and 1991 have negative and highly significant coefficients, which is not the case for the other years (except the positive coefficient for 1988 already noted above). Our results are therefore fully consistent with those obtained by Burkhauser et al. (2000). There is a negative minimum wage effect associated with (federal) minimum wage hikes but in a model with fixed state effects the inclusion of year dummies causes the effect to be of smaller absolute magnitude and statistically insignificant. However, for the period 1984-89, a further finding emerges: state minimum wage hikes had no significant negative effects on teenage employment. Only federal hikes are found to have a negative impact on teenage employment.

IV. The impact of federal and state minimum wage hikes in the 1990s

For 1990 the minimum wage variable is the difference $\log(3.80) - \log(3.35)$ for states which did not have increases since the 1981 federal hike and a smaller value, $\log(3.80) - \log(\text{state minimum})$ for other states, except where the state minimum was already above 3.80. In order to further explore the state-federal dichotomy, we next create a separate variable for state-level and federal minimum increases. For the increase in federal minimum we define the variable:

$$\text{FED} = \max(\text{DMW}, 0)$$

where $DMW = \{\log(3.80) - \log(\max[3.35, \text{state minimum}])\} \times \text{dummy for the quarters } 1990(2) \text{ to } 1991(1) \text{ if the state minimum is less than } \3.80 . For state-level increases we define the variable:

$STATE = \Delta m_{st}$ for the period 1985(1) – 1990(1) and for 1990(2) to 1991(1) if the state minimum is above \$3.80.

This enables us to test whether state and federal minimum wage increases have similar effects in the following equation:

$$\Delta E_{st} = \lambda_1 \Delta U_{st} + \lambda_2 \Delta P_{st} + \lambda_3 \Delta w_{st} + \theta_S STATE_{st} + \theta_F FED_{st} + \xi_{st} \quad (2)$$

In the second column of Table 2, the results from the equation with these separate minimum wage variables using data for the years 1984-91(1) are presented. The coefficient on the state minimum wage variable is negative (but numerically small in absolute value) and statistically insignificant. The federal variable on the other hand is highly significant and negative, with an implied elasticity of -0.45. It is clear then that the 1990 federal minimum wage hike did have a statistically significant and negative impact on teenage employment. This finding is further reinforced by including the hike that took the federal minimum from \$3.80 in 1990 to \$4.25 in 1991 (column 3). When the state and the two federal minimum wage increases are entered separately along the lines of equation (3), the state minimum wage variable is negative but insignificant while both federal hikes are found to have significant, negative effects on teenage employment. The conclusion that

emerges for the 1980s and early 1990s is that federal hikes have a significant negative effect on teenage employment whereas increases in state minima do not.

We next examine what happened after 1991 in order to see whether the same conclusion holds. The next rise in the federal rate to \$4.75 was implemented in the final quarter of 1996 and was quickly followed by a hike to \$5.25 in third quarter of 1997. Between 1992 and 1995, there were only four state-level minimum wage increases – see Figure 1. One of these is the increase from \$4.25 to \$5.05 in New Jersey which is the subject of the famous Card and Krueger (1994) article. We proceed as before by estimating equation (1) for the period 1992-95 in which there were only four state-level increases (Table 3, column 1). The minimum wage coefficient is negative and insignificant, and in line with the earlier finding that state minimum wage hikes have no statistically significant effect on teenage employment. This conclusion is not altered by the inclusion of year dummies (column 2). The same equation is next estimated for the period ending 1997(2) during which the federal minimum wage was raised to \$4.75 but before it was raised to \$5.25 in 1997(3). The minimum wage coefficient is negative and significantly different from zero (column 3). The implied elasticity is -0.25, which is smaller in absolute value than the figure for the 1990-91 hikes. However, there is no significant minimum wage effect when year dummies are included (column 4). Including data for 1997(3)-1998(2) when there was a further hike, alters this conclusion. The coefficient is negative but numerically small (in absolute value) and statistically insignificant.

Estimating the equation with separate state and federal minimum wage effects using equation (3) confirms these findings (Table 4, columns 2 and 3). The 1996 hike had a significant negative impact on teenage employment, but the effect of the 1997 hike is found to be positive though not significant. The period after 1991 therefore provides additional support for the conclusion that state minimum wage increases do not have any significant negative impact on teenage employment. However, only the 1996 the federal minimum wage hike has a statistically significant negative impact.

V. Why do state-level minimum wage hikes have no detrimental effect on teenage employment?

Given the dichotomy between the effects of state-level and federal minimum wage hikes, it is important to understand what is driving this apparently robust result. In theory a given increase in the minimum wage in a state should have the same impact whether the increase is determined at the state or federal level. However, the economic structure of states differs widely and the distribution of wages may be quite different so that a given minimum wage will be more binding in low wage states. It was pointed out earlier that during the 1980s most of the state-level minimum wage increases were implemented in the New England states which are not low-wage states.

It is possible that the employment effect may already taken place in the past. Prior to 1982 there had been a number of substantial federal minimum wage hikes, and subsequent marginal increases in the wage floor set at the state level during the 1980s did not entail any further employment effect. The same kind of argument

could be made to explain the absence of negative effects in New Jersey in 1992 – the teenage employment rate had already declined from 47% in 1988 to 36% in 1991.

The size of the federal hikes are also large compared to those implemented at state level. The only substantial increases (of more than 10% in a given year) were in California, Connecticut and Washington. When the federal minimum was increased it rose by 13% in 1990, 12% in 1991, 12% in 1996 and 10% in 1997. These are very large increases over a period of two years (27% for 1990-1 and 19% for 1995-6) and they affected more than 30 states. It is not unexpected that they had an impact on employment whereas the smaller state-level increases did not.

For states which either have no minimum wage apparatus or decided simply not to raise their minimum rates in the 1980s, the federal minimum wage hikes of 1990 and 1991 represented a regime change. During the period in which the federal minimum was frozen, employers may have adopted different approach to recruitment and retention, based on paying low wages. There is clear evidence of a substantial increase in earnings inequality in the lower half of the earnings distribution between 1981 and 1990 due largely to the relative decline in the federal minimum wage (see Dinardo et al, 1996, Lee, 1999 and Teulings, 2003). When an effective wage floor was reinstated, employers cut teenage employment. Infrequent hikes in the federal minimum create abrupt regime changes and as a consequence have adverse effects on employment. States which increased their minimum wage often did so more than once thereby maintaining a stable regime (see Figure 1).

One way of evaluating this possibility is by testing whether teenage employment in states with their own minimum wages reacts differently to federal hikes. This is done by using separate variables for the federal hikes in equation (2):

$$\Delta E_{st} = \lambda_1 \Delta U_{st} + \lambda_2 \Delta P_{st} + \lambda_3 \Delta W_{st} + \theta_S STATE_{st} + \theta_{FF} FFED_{st} + \theta_{FS} SFED_{st} + \xi_{st}$$

where the variable SFED is equal to the rise in the effective minimum wage in states where the state minimum lies between the old and new federal minimum (and zero in all other cases). FFED is the increase in the federal minimum in states without their own minimum wage. The results of this exercise are presented in Tables 5 (a) and (b) for the federal hikes of 1990-91 and 1996-97 respectively. In each case the effect of the federal minimum wage on teenage employment in these states is not significantly different from zero, even though the relevant coefficient is negative for the 1996 hike. This relatively weak test suggests that it is federal minimum wage hikes in states without their own minimum wage apparatus that have negative effects on teenage employment. In states where the minimum wage had increased during the 1980s, the increase in youth labor cost was small or non-existent and thus there was no significant effect on employment.

VI. Concluding remarks

By examining the impact of minimum wage hikes in different sub-periods, we are able to show that during the 1980s and 1990s, state minimum wage increases in general had no significant negative impact on teenage employment whereas federal hikes did. This asymmetry has a number of implications. It provides an explanation of why studies find conflicting results for the period in question. The new

economics of the minimum wage, which is based on the idea that the latter does not have adverse effects on employment, is founded on case studies of state-level minimum wage hikes. Recent studies that find a negative impact on employment examine (or include in the analysis) federal hikes. The state-federal dichotomy could therefore be the answer to the puzzle of why studies find conflicting results. It also suggests that a gradualist approach, in which minimum wages are raised regularly by small amounts thereby maintaining a floor to wages, may not give rise to significant employment impact as firms operate within a stable regime.

References

Bazen, Stephen and Velayoudom Marimoutou (2002), “Looking for a needle in a haystack? A re-examination of the time series relationship between teenage employment and minimum wages in the United States”, *Oxford Bulletin of Economics and Statistics*, Vol 64, 699-725.

Brown, Charles, Curtis Gilroy and Andrew Kohen (1982), “The effect of the minimum wage on employment and unemployment”, *Journal of Economic Literature*, Vol 20, 487-528.

Brownstone, David and Robert Valetta (2001), “The bootstrap and multiple imputations: harnessing increased computing power for improved statistical tests”, *Journal of Economic Perspectives*, Vol 15, No 4, 129-141.

Burkhauser, Richard, Kenneth A. Couch and David C. Wittenberg (2000), “A reassessment of the new economics of the minimum wage literature using monthly data from the CPS”, *Journal of Labor Economics*, October, Vol 18, 653-680.

Card, David and Alan Krueger (1994), “Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania”, *American Economic Review*, Vol. 84, 772-793.

Card, David and Alan Krueger (1995), *Myth and Measurement: The New Economics of the Minimum Wage*, Princeton University Press, New Jersey, 1995.

Card, David and Alan Krueger (2000), “Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Reply”, *American Economic Review*, Vol. 90, 1397-1420.

Deere, Donald, Kevin Murphy and Finis Welch (1995), "Employment and the 1990-1991 minimum wage hike", *American Economic Review, Papers and Proceedings*, Vol 85, 232-237.

Neumark, David and William Wascher (1992), "Employment effects of minimum wages and subminimum wages: panel data on state minimum wage laws", *Industrial and Labor Relations Review*, Vol 46, 55-81.

Neumark, David and William Wascher (2000), "Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania: Comment", *American Economic Review*, Vol 90, 1362-1396.

Neumark, David and William Wascher (2002), "State-level estimates of minimum wages: new evidence and interpretations from disequilibrium methods", *Journal of Human Resources*, Vol 37, 36-62.

Williams, Nicolas and Jeffrey Smith (2001), "The minimum wage and teenage employment: Evidence from time series", *Applied Economics*, Vol 33, 285-300.

Appendix

Table A. 1: Means* and standard deviations of the variables used					
	<i>1984</i>	<i>1989</i>	<i>1991</i>	<i>1995</i>	<i>1997</i>
<i>Teenage employment population ratio</i>	0.446 (0.071)	0.484 (0.066)	0.426 (0.079)	0.446 (0.089)	0.434 (0.092)
<i>Average earnings in dollars</i>	8.94 (0.89)	10.15 (1.16)	10.85 (1.19)	12.13 (1.02)	12.65 (1.03)
<i>Unemployment rate (%)</i>	5.42 (1.93)	2.86 (0.81)	4.14 (1.12)	0.77 (0.03)	0.76 (0.04)
<i>Teenage to adult population ratio</i>	0.1 (0.007)	0.09 (0.008)	0.084 (0.007)	0.084 (0.011)	0.088 (0.010)
Mean annual variations					
	<i>1984-89</i>	<i>1989-91</i>	<i>1991-95</i>	<i>1995-7</i>	
<i>Teenage employment population ratio</i>	+ 0.007 (0.03)	-0.028 (0.04)	+0.005 (0.03)	-0.006 (0.033)	
<i>Average earnings in dollars</i>	+0.26 (0.28)	+0.32 (0.25)	+0.32 (0.41)	+0.29 (0.36)	
<i>Unemployment rate (%)</i>	-0.5 (0.96)	+0.63 (0.81)	-0.84 (1.82)	-0.009 (0.32)	
<i>Teenage to adult population ratio</i>	-0.002 (0.005)	-0.003 (0.005)	+0.0001 (0.005)	+0.002 (0.006)	
* Annual data weighted by state population levels. Standard deviations in parentheses.					

Table 1 Effects of state and federal minimum wage hikes 1985-92(1)

[illegible]

Table 2 Analysis of the state-federal minimum wage dichotomy 1984-1992(1)			
	(1)	(2)	(3)
	<i>1984-89</i>	<i>1984-91(1)</i>	<i>1984-92(1)</i>
<i>Log State minimum wage</i>	0.006 (0.078)	-0.020 (0.069)	-0.016 (0.069)
<i>Log Federal minimum wage 1990</i>	-	-0.275** (0.049)	-0.267** (0.048)
<i>Log Federal minimum wage 1991</i>	-	-	-0.232** (0.051)
<i>Unemployment rate</i>	-0.0014 (0.0013)	-0.0021 (0.0012)	-0.0025* (0.0012)
<i>Teenage population ratio</i>	-0.011 (0.213)	-0.071 (0.190)	-0.011 (0.185)
<i>Average earnings</i>	0.097** (0.036)	0.088** (0.034)	0.072* (0.034)
<i>Uncentred R²</i>	0.010	0.041	0.054
<i>Number of observations</i>	960	1200	1392
All variables expressed as first differences Bootstrap standard errors in parentheses ** (*) significant at 1% (5%)			

Table 3 Effects of state and federal minimum wage hikes 1992-97						
	(1)	(2)	(3)	(4)	(5)	(6)
	<i>1992(2)- 96(3)</i>	<i>1992(2)- 96(3)</i>	<i>1992(2)- 97(2)</i>	<i>1992(2)- 97(2)</i>	<i>1992(2)- 98(2)</i>	<i>1992(2)- 98(2)</i>
<i>Log Minimum wage</i>	-0.158 (0.102)	-0.138 (0.102)	-0.113** (0.041)	-0.016 (0.058)	-0.008 (0.027)	0.033 (0.055)
<i>Unemployment rate</i>	-0.0031** (0.0011)	-0.0011 (0.0020)	-0.0029** (0.0011)	-0.0013 (0.0019)	-0.0032** (0.0011)	-0.0011 (0.0019)
<i>Teenage population ratio</i>	-0.179 (0.239)	-0.250 (0.252)	-0.145 (0.224)	-0.256 (0.223)	-0.274 (0.204)	-0.274 (0.221)
<i>Average earnings</i>	0.078* (0.034)	0.067 (0.038)	0.084* (0.032)	0.057 (0.036)	0.071* (0.031)	0.060 (0.035)
<i>Year dummies</i>	No	Yes	No	Yes	No	Yes
<i>Uncentred R²</i>	0.026	0.037	0.025	0.034	0.018	0.039
<i>Number of observations</i>	864	864	1008	1008	1200	1200
All variables expressed as first differences						
Bootstrap standard errors in parentheses ** (*) significant at 1% (5%)						

Table 4 Analysis of the state-federal minimum wage dichotomy 1992(2)- 1998(2)			
	(1)	(2)	(3)
	<i>1992(2)- 96(3)</i>	<i>1992(2)- 97(2)</i>	<i>1992(2)- 98(2)</i>
<i>Log State minimum wage</i>	-0.158 (0.102)	-0.124 (0.076)	-0.037 (0.057)
<i>Log Federal minimum wage 1996</i>	-	-0.108* (0.050)	-0.102* (0.046)
<i>Log Federal minimum wage 1997</i>	-	-	0.089* (0.046)
<i>Unemployment rate</i>	-0.0031** (0.0011)	-0.0029** (0.0011)	-0.0032** (0.0011)
<i>Teenage population ratio</i>	-0.179 (0.239)	-0.148 (0.215)	-0.252 (0.214)
<i>Average earnings</i>	0.078* (0.034)	0.084* (0.033)	0.071* (0.032)
<i>Uncentred R²</i>	0.026	0.025	0.024
<i>Number of observations</i>	864	1008	1200
All variables expressed as first differences Bootstrap standard errors in parentheses ** (*) significant at 1% (5%)			

Table 5(a) Further analysis of the state-federal minimum wage dichotomy 1984-1992(1)		
	(1)	(2)
<i>Impact on teenage employment of :</i>	<i>1984-91(1)</i>	<i>1984-92(1)</i>
<i>Increases in state minimum wage not caused by a federal hike</i>	-0.020 (0.068)	-0.030 (0.058)
<i>Increase in state minimum wage when overtaken by federal rate in 1990</i>	0.01 (0.45)	0.023 (0.452)
<i>Increase federal minimum wage 1990</i>	-0.278** (0.048)	-0.271** (0.048)
<i>Increase in state minimum wage when overtaken by federal rate in 1991</i>	-	-0.196 (0.241)
<i>Increase in federal minimum wage 1991</i>	-	-0.210** (0.066)
<i>Number of observations</i>	1200	1392
Coefficient on the log of the relevant minimum wage Bootstrap standard errors in parentheses ** (*) significant at 1% (5%)		

Table 5(b) Further analysis of the state-federal minimum wage dichotomy 1992(2)- 1998(2)		
	(1)	(2)
<i>Impact on teenage employment of :</i>	<i>1992(2)- 97(2)</i>	<i>1992(2)- 98(2)</i>
<i>Increases in state minimum wage not caused by a federal hike</i>	-0.124 (0.073)	-0.037 (0.058)
<i>Increase in state minimum wage when overtaken by federal rate in 1996</i>	-0.576 (0.749)	-0.589 (0.763)
<i>Increase federal minimum wage 1996</i>	-0.106* (0.050)	-0.100* (0.048)
<i>Increase in state minimum wage when overtaken by federal rate in 1997</i>	-	0.041 (0.437)
<i>Increase in federal minimum wage 1997</i>	-	0.089 (0.047)
<i>Number of observations</i>	1008	1200
All variables expressed as first differences Bootstrap standard errors in parentheses ** (*) significant at 1% (5%)		

Figure 1: State-level minimum wage increases 1985-1996

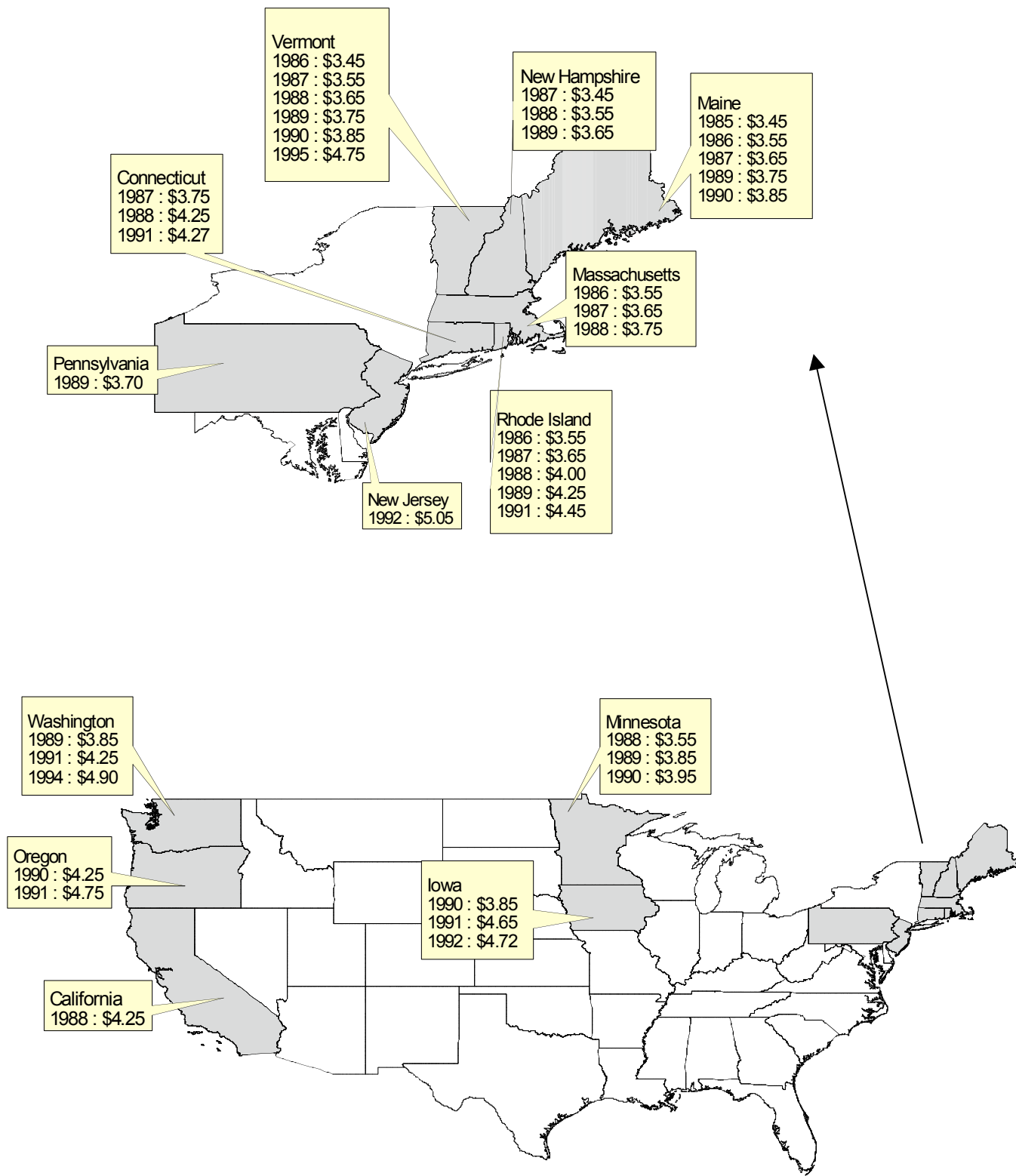


Figure 2. Teenage employment and state-level minimum wage increases, 1985-89

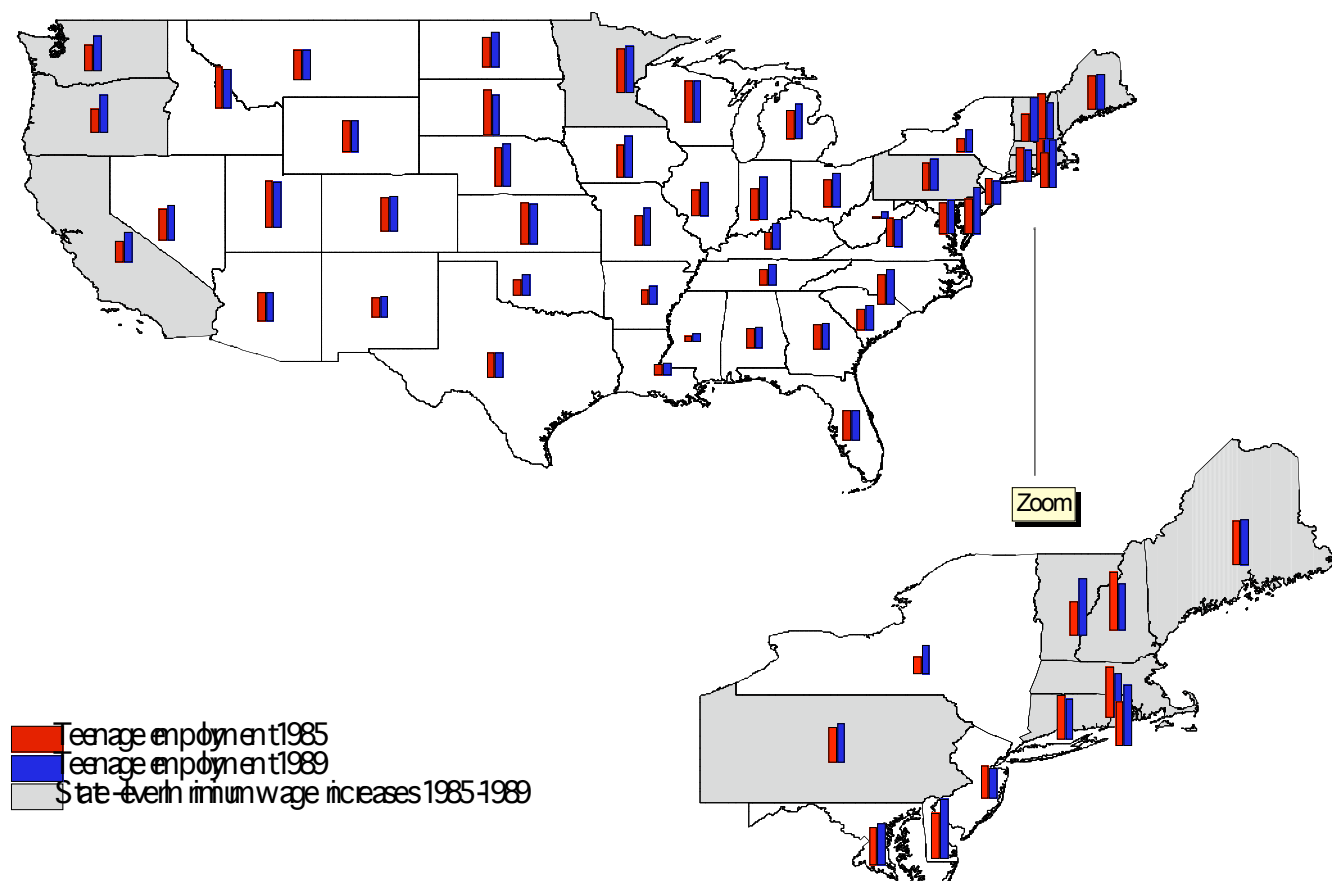


Figure 3. Teenage employment and state-level minimum wage increases, 1992-95

